Missouri Department of Natural Resources

Facility Plan Guidance for Wastewater Treatment Facilities with a Design Flow of 22,500 gpd or Greater

Water Protection Program fact sheet 9/2011

This document provides engineering consultants a comprehensive guide of the Missouri Department of Natural Resources' recommendations and requirements for an approvable facility plan for facilities with a design flow of 22,500 gallons per day, or gpd, or greater that will not receive funding from the department.

Projects receiving funding from the department under 10 CSR 20-4 require additional information in the facility plan. More information concerning department funding and fact sheets for the Clean Water State Revolving Fund Project Facility Plan Guidance and State Forty Percent Construction Grant Project Facility Plan Guidance is available online at www.dnr.mo.gov/env/wpp/srf/index.html.

Until 10 CSR 20-8.020 can be amended, 10 CSR 20-8.110 shall apply to all facilities with a design flow of 22,500 gpd or greater. 10 CSR 20-8.110 shall apply to all facilities with a design flow of 100,000 gpd or greater after 10 CSR 20-8.020 is amended.

The facility plan must include sufficient detail to demonstrate the proposed project meets applicable criteria. The data presented in the facility plan is the basis for the detailed design of the construction plans and specifications.

Facility plans must be approved by the department prior to the submittal of plans and specifications, construction permit application and associated fee(s).
See 10 CSR 20-8.110(3)(C).

The following is a sample format for the required facility plan content:

Title Page
Include the following:

- Name of the project.
- Owner of the system.
- Contact information.
- Date of the submittal.
- Missouri registered professional engineer seal, signature and date.
  See 10 CSR 20-8.110(3)(D).

Table of Contents
Identify the headers, figures, tables and appendices locations.

Introduction
State the purpose for the project. Describe the existing system, including an evaluation of the existing conditions and problems needing correction. Provide a summary of existing and previous local and regional wastewater facility planning documents, if applicable. Include any schedules of compliance, enforcement administrative orders or agreements.
See 10 CSR 20-8.110(4)(C)1.

Planning and Service Area
Identify the planning area, the existing and potential future service area, the site of the project, anticipated location and alignment of proposed facilities on a map or sketch.
See 10 CSR 20-8.110(4)(C)2.

Population Projection and Planning Period
Base the present and predicted population on a 20 year planning period. Phased construction of wastewater facilities shall be considered in rapid-growth areas. Sewers and other facilities with a design life in excess of 20 years shall be designed for the extended period.
See 10 CSR 20-8.110(4)(C)3.

Existing Facilities Evaluation
Existing Collection System
Include a brief inventory of the collection system (e.g., the approximate miles of gravity sewers and force mains, the number of pumping stations and related pumping station capacity). An analysis of the existing collection system is not required if the project is for a wastewater treatment facility only. Communities that have large collection systems need only report on the colletion system in the drainage basin in which the project is located.

If an inflow/infiltration, or I/I, analysis has been conducted, present the findings of the study along with the recommendations for the most cost-effective I/I reductions.

Communities that experience sanitary sewer overflows, or SSOs, must propose a plan for the reduction and eventual elimination of these overflows. The proposed project will not have to achieve SSO elimination; however, any permit or enforcement schedules must be addressed.

Existing Wastewater Treatment Facility
Provide a detailed description of the existing wastewater treatment facility. Include an estimate of the hydraulic and organic loading capacity for the whole facility and each process unit. The age and condition of each process unit should be evaluated and presented. Problems with the current wastewater treatment facility should be identified and recommendations made for corrections. A sketch or process diagram of the wastewater treatment facility is desired.
A copy of the current Missouri State Operating Permit, or MSOP, should be provided.

Hydraulic Capacity Determination
For consistency, use the following flow definitions as a basis for the design of sewers, pumping stations, wastewater treatment facilities, treatment units and other wastewater handling facilities.
See 10 CSR 20-8.110(4)(C)4.A.

- **Design average flow** – The design average flow is the average of the daily volumes to be received for a continuous 12 month period expressed as a volume per unit time. However, the design average flow for facilities having critical seasonal high hydraulic loading periods (e.g., recreational areas, campuses and industrial facilities) shall be based on the daily average flow during the seasonal period.

- **Design maximum daily flow** – The design maximum daily flow is the largest volume of flow to be received during a continuous 24 hour period expressed as a volume per unit time.
- **Design peak hourly flow** – The design peak hourly flow is the largest volume of flow to be received during a one hour period expressed as a volume per unit time.
- **Design peak instantaneous flow** – The design peak instantaneous flow is the instantaneous maximum flow rate to be received.

Existing Systems

Flow projections for the design life of the system shall be made using actual flow data to the extent possible. Evaluate the probable degree of accuracy of data and flow projections. This reliability estimation shall include an evaluation of the accuracy of existing data, based on no less than one year of data. Also, provide an evaluation of the reliability of estimates of flow decreases anticipated due to I/I reduction or flow increases due to elimination of SSOs and basement backups. Include critical data and methodology. Graphical displays of critical peak wet weather flow data shall be included for a sustained wet weather flow period of significance to the project. See 10 CSR 20-8.110(4)(C)4.B.

If the existing wastewater treatment facility is a lagoon, install a flow measurement device at the influent. One year of flow measurement data from this location will provide a more accurate flow representation.

New Systems

New sewer systems and wastewater treatment facilities shall be based on an average daily flow of 100 gpd per capita. Also, consider flow from industrial facilities and major institutional and commercial facilities. However, an alternate flow based on water use data or other justification, which better estimates flow, may be provided. See 10 CSR 20-8.110(4)(C)4.C.(I).

The peaking factor, determined by Figure 1 in 10 CSR 20-8.110(4)(C)4.C.(II), shall be multiplied by the projected design average flow to determine the peak hourly flow. The peaking factor accounts for normal infiltration for collection systems built with modern construction techniques. See 10 CSR 20-8.110(4)(C)4.C.(II).

If the new collection system is to serve an existing development, the likelihood of I/I contributions from existing service lines and non-wastewater connections to those service lines shall be evaluated. Wastewater treatment facilities shall be designed accordingly to account for these additional flows. See 10 CSR 20-8.110(4)(C)4.C.(III).

Combined Sewer Interceptors

Interceptors for combined sewers shall have the capacity to receive sufficient quantity of combined wastewater for transport to wastewater treatment facilities to ensure attainment of the appropriate water quality standards. See 10 CSR 20-8.110(4)(C)4.D.

Organic Capacity Determination

For consistency, use the following organic load definitions as a basis for the design of wastewater treatment facilities. See 10 CSR 20-8.110(4)(C)5.A.

- **Biochemical Oxygen Demand** – The five day Biochemical Oxygen Demand, or BOD_5, is defined as the amount of oxygen required to stabilize biodegradable organic matter under aerobic conditions within a five day period.
- **Total five day Biochemical Oxygen Demand, or $TBOD_5$** – $TBOD_5$ is equivalent to BOD_5 and is sometimes used in order to differentiate carbonaceous plus nitrogenous oxygen demand from strictly carbonaceous oxygen demand.

- **Carbonaceous five day Biochemical Oxygen Demand, or $CBOD_5$** – $CBOD_5$ is defined as BOD_5 less the nitrogenous oxygen demand of the wastewater.
- **Design average BOD_5** – The design average BOD_5 is generally the average of the organic load received for a continuous 12 month period for the design year expressed as weight per day. However, the design average BOD_5 for facilities having critical seasonal high loading periods (e.g., recreational areas, campuses and industrial facilities) shall be based on the daily average BOD_5 during the seasonal period.
- **Design maximum day BOD_5** – The design maximum BOD_5 is the largest amount of organic load to be received during a continuous 24 hour period expressed as weight per day.
- **Design peak hourly BOD_5** – The design peak hourly BOD_5 is the largest amount of organic load to be received during a one hour period expressed as weight per day.

Existing Systems:
Projections shall be made from actual wasteload data to the extent possible. Evaluate the probable degree of accuracy of data and wasteload projections. Impacts of industrial sources shall be documented. See 10 CSR 20-8.110(4)(C)5.B.

New Systems:
Domestic wastewater treatment design shall be based on at least 0.17 pounds of BOD_5 per capita per day and 0.20 pounds of suspended solids per capita per day, unless information is submitted to justify alternate designs. Impacts of industrial sources shall be documented. Data from similar wastewater treatment facilities may be used in the case of new systems. However, a thorough and documented investigation to establish the reliability and applicability of data from a similar wastewater treatment facility shall be provided.
See 10 CSR 20-8.110(4)(C)5.C.

Project Alternative Analysis
Evaluating two or more alternatives is recommended.

Collection System Extensions/Rehabilitations:
Discuss proposed revisions to the existing or proposed collection system including the adequacy of portions not being changed by the project. See 10 CSR 20-8.110(4)(C)8.A.

Wet Weather:
Proposed wastewater treatment facilities and collection systems shall provide for transportation and treatment of all flows including wet weather flows. If bypasses have been authorized by the department, provide the appropriate documentation. See 10 CSR 20-8.110(4)(C)8.B.

Site Evaluation:
Provide the appropriate site evaluation information.

Compatibility of the treatment process with the present and planned future land use, including noise, potential odors, air quality and anticipated sludge processing and disposal techniques, shall be considered. Non-aerated lagoons should not be used if excessive sulfate is present in the wastewater. Wastewater treatment facilities should be separate from habitation or any area likely to be built up within a reasonable future period and shall be separated in accordance with state and local requirements. See 10 CSR 20-8.110(4)(C)8.C.(I).

Identify zoning and other land use restrictions. See 10 CSR 20-8.110(4)(C)8.C.(II).

Include an evaluation of the accessibility and topography of the site.
See 10 CSR 20-8.110(4)(C)8.C.(III).

Identify areas for future wastewater treatment facility expansions.
See 10 CSR 20-8.110(4)(C)8.C.(IV).

Identify the direction of prevailing wind(s). See 10 CSR 20-8.110(4)(C)8.C.(V).

Wastewater treatment facility design must take into consideration flood protection. The facility should remain operational and accessible during a 25 year flood. Facility structures, electrical and mechanical equipment shall be protected from damage during a 100 year flood. See 10 CSR 20-8.110(4)(C)8.C.(VI) and 10 CSR 20-8.140(3)(A).

Geologic information, depth to bedrock, karst features, or other geologic considerations of significance to the project shall be included. A copy of a geological site evaluation from the department's Division of Geology and Land Survey, or DGLS, providing stream determinations (gaining or losing) must be included for all new wastewater treatment facilities. A copy of a geological site evaluation providing site collapse and overall potentials from DGLS, must be included for all earthen basin structures. Earthen basin structures shall not be located in areas receiving a severe overall geological collapse potential rating.
See 10 CSR 20-8.110(4)(C)8.C.(VII). The *Request for Geohydrologic Evaluation of Liquid-Waste Treatment Facility/Site*, Form—MO 780-1688 is available online at www.dnr.mo.gov/forms/index.html#Geology.

Protection of groundwater including public and private wells is of utmost importance. Demonstrate adequate protection. If the proposed wastewater facilities will be near a drinking water source or other water facility, as determined by DGLS or by the department's Public Drinking Water Branch, address the allowable distance between the wastewater facilities and drinking water sources and facilities. See 10 CSR 20-8.110(4)(C)8.C.(VIII).

Determine soil type and suitability for construction and depth to normal and seasonal high groundwater. See 10 CSR 20-8.110(4)(C)8.C.(IX).

The location, depth and discharge point of any field tile in the immediate area of the site shall be identified. See 10 CSR 20-8.110(4)(C)8.C.(X).

Access to the receiving stream for the wastewater treatment facility outfall shall be discussed and displayed. See 10 CSR 20-8.110(4)(C)8.C.(XII).

Include a preliminary assessment of site availability. See 10 CSR 20-8.110(4)(C)8.C.(XIII).

Unit Sizing
Unit operation and preliminary unit process sizing and basis shall be discussed.
See 10 CSR 20-8.110(4)(C)8.D.

Flow Diagram
Provide a preliminary flow diagram of treatment facilities including all recycle flows.
See 10 CSR 20-8.110(4)(C)8.E.

Emergency Operations
Discuss emergency operation requirements in accordance with 10 CSR 20-8.130 and 10 CSR 20-8.140. See 10 CSR 20-8.110(4)(C)8.F.

No-discharge Option
Consideration shall be given to the feasibility of constructing and operating a no-discharge wastewater treatment facility. See 10 CSR 20-6.010(4)(D)1 and 10 CSR 20-8.110(4)(C)8.G.

Regionalization
Consideration should be given to the transport of wastewater to a regional wastewater treatment facility, when feasible. See 10 CSR 20-6.010(3)(C).

Decentralized Options
Consideration should be given to centralized management of on-site wastewater systems for unsewered communities.

Technology not included in 10 CSR 20-8
Identify any innovative or new technology, for which the review process will be as stated in 10 CSR 20-8.140(5)(B). See 10 CSR 20-8.110(4)(C)8.H.

Deviations from 10 CSR 20-8
If this project contains known deviations from 10 CSR 20-8, submit the documentation and justification for the deviation. Note that many deviations are common while others are reviewed on a case-by-case basis. See 10 CSR 20-8.110(4)(C)10.

Biosolids
Discuss solids handling, disposal options and method selected. Compliance with the requirements of 10 CSR 20-8.170 and any conditions in the applicants MSOP must be assured. See 10 CSR 20-8.110(4)(C)8.I.

Treatment during Construction
Include the plan for the method and level of treatment to be achieved during construction. The treatment during construction plan must be approved by the department and implemented by inclusion in the plans and specifications. See 10 CSR 20-8.110(4)(C)8.J.

Operation and Maintenance
Portions of the project that involve complex operation or maintenance requirements shall be identified including laboratory requirements for operation, industrial sampling and self monitoring. See 10 CSR 20-8.110(4)(C)8.K.

Communities that do not propose to employ a full-time operator, 40 hours per week, should evaluate passive or easy-to-operate treatment alternatives before considering a mechanical activated sludge package plant. Examples of passive or easy-to-operate treatment systems include, but are not limited to, enhanced natural systems, submerged fixed film systems, sand filters and recirculating pea gravel filters.

Cost Estimates
Cost estimates for capital and operation and maintenance should be included for each alternative.

Water Quality Reports
The department's determination of probable effluent limits must be included. Proposed wastewater treatment facilities shall provide for meeting the effluent limitations as determined by the department with the use of 10 CSR 20-7.015 and 10 CSR 20-7.031. Supply the Antidegradation Review Report in accordance with 10 CSR 20-7.031(2), the Water Quality Antidegradation Review determination by the department and any special water quality studies completed by or on the behalf of the applicant. See 10 CSR 20-8.110(4)(C)8.N. More information concerning
the antidegradation review process is available online at

www.dnr.mo.gov/env/wpp/permits/antideg-implementation.htm.

208b Plans
The project shall be consistent with the approved elements of any applicable water quality management plan under Section 208b of the Federal Clean Water Act. See 10 CSR 20-6.010(9)(F). Contact the department for a list of cities that have 208b management plans.

Recommended Project Alternative Summary and Justification
Identify the recommended alternative and provide justification.

Provide the following costs and an estimation of how long these costs are applicable for the recommended project:
- Construction.
- Engineering.
- Land.
- Legal.
- Administrative costs.
- Operation and maintenance.
- Average user charge, including documentation of the basis of the estimate.

For the recommended alternative, include the following:
- Wastewater treatment facility design average and peak flows.
- Wastewater treatment facility design organic loading.
- For wastewater treatment facility improvement projects, indicate what treatment units are to be upgraded or added.
- For collection system projects, indicate the average and peak hourly flow requirements for sewers and pumping stations.
- Engineering criteria used for preliminary sizing of facilities.

Appendices
The following information shall be included in the appendices upon request of the department depending on the complexity of the proposed project. All design data shall be considered preliminary for review purposes by the department. See 10 CSR 20-8.110(4)(D).

Process Facilities
Provide the criteria and basis of selection, hydraulic and organic loadings (e.g., minimum, average and maximum) and the effect on wastewater and sludge processes, unit dimensions, rates and velocities, detention concentrations, recycle, chemical additive control, physical control and flow metering, removal efficiencies, effluent concentrations, energy requirements and flexibility. See 10 CSR 20-8.110(4)(D)1.

Process Diagrams
Provide diagrams depicting process configuration, interconnecting piping, processing, flexibility, hydraulic profile, organic loading profile, solids profile, solids control system and flow diagram with capacities. See 10 CSR 20-8.110(4)(D)2.

Laboratory
Discuss physical and chemical tests and the frequency to control processes, time for testing, space and equipment requirements, description of the laboratory facility and personnel requirements (e.g., number, type, qualifications, training, salaries and benefits).
See 10 CSR 20-8.110(4)(D)3.

Operation and Maintenance
Discuss routine and special maintenance duties, time requirements per duty, tools necessary, spare parts list, equipment, vehicles, safety, maintenance workspace and storage and personnel requirements (e.g., number, type, qualifications, training, salaries and benefits).
See 10 CSR 20-8.110(4)(D)4.

Chemical Control
Identify processes needing chemical addition, type of chemicals, feed equipment and associated costs. See 10 CSR 20-8.110(4)(D)5.

Collection Systems Contro
Discuss cleaning and maintenance, regulator and overflow inspection and repair, flow gauging, industrial sampling and surveillance, ordinance enforcement, equipment requirements, trouble-call investigations and personnel requirements (e.g., number, type, qualifications, training, salaries and benefits). See 10 CSR 20-8.110(4)(D)6.

Control Summary
Identify personnel, equipment, chemicals, utilities and power requirements of major units.
See 10 CSR 20-8.110(4)(D)7.

For More Information

Missouri Department of Natural Resources
Water Protection Program
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800-361-4827 or 573-751-1300
www.dnr.mo.gov/env/wpp/index.html